existing plant it gives one food for considerable thought.

The success of Edgewood Arsenal and the gas mask factories was due in no small measure to the inauguration of a development division intermediate between the Research Department and the manufacturing plants. The difficulties attending large-scale production were overcome in the single-unit plants of the development section, and the results obtained immediately transferred to Edgewood and the subsidiary factories spread up and down the country. Only in this way was it possible to maintain throughput at its maximum and avoid the time- and labour-consuming hindrances notoriously attendant on the alteration of existing plant or the installation of new. It is a procedure heartily to be commended to many of our own industrial concerns, where much good research is wasted by inability of the works to cope with difficulties which could well be overcome by experimentation on full-sized units.

Of course, even in America, the enormous chemical warfare organisation did not come into being without attendant inefficiencies. General Fries points out the difficulties he encountered in having his cabled demands from the Expeditionary Force attended to (did he but know it, he was no worse off in this way than the British, who were fighting almost at their own door). This was due to a lack of co-ordination between the numerous extensive divisions of the service, each of which had grown up separately. Eventually a Chief of the Chemical Warfare Service was appointed, but in the interim the various separate activities were held together only by the personal efforts of William H. Walker, of the Massachusetts Institute of Technology. General Fries and Major West are not sufficiently appreciative of Walker's efforts during this disquieting period. In service to his country Walker accomplished in this unofficial co-ordination something even greater than his subsequent organisation and control of Edgewood Arsenal. Without him General Fries and the American Expeditionary Force would have had to remain dependent for supplies on Britain for many months longer than they did.

The book is full of information of a technical nature previously denied to the average man of science, and even without its clarity and illuminating illustrations would hold the reader enthralled from start to finish. It is a fine compilation and a great tribute to American chemists. Its publication can do nothing but good in throwing light on a subject of ever-increasing international importance. Its extensive sections, dealing with the legitimacy of gas warfare and its possibilities in the future, are highly stimulating, but must be read in conjunction with the remainder properly to be appreciated. Sufficient has been quoted above to indicate the authors' views on the subject.

No British notice of "Chemical Warfare" would be complete without reference to the now notorious "Lewisite." Whatever the British views as to the war value of chlorovinyldichloroarsine, the fact remains that the Americans rated, and still rate, it very highly indeed. It was under the strictest pledges of official secrecy that its nature and mode of preparation were imparted to the British Government. It is therefore most disquieting to find it made the subject of a communication to a scientific society without express permission being obtained from the real owners of the secret. As the communication was sanctioned by the War Office, there would appear to be two explanations required—one from the military authorities, and the other from the authors of the paper referred to. Doubtless some satisfactory explanation can be given of this "unfortunate, or otherwise" (Fries and West), occurrence, but the Official Secrets Act, our friendly relations with foreign Governments, and respected procedure regarding scientific publication, all appear to be involved.

S. J. M. A.

Zoology for Medical Students.

Zoology for Medical Students. By Prof. J. Graham Kerr. Pp. x+485. (London: Macmillan and Co., Ltd., 1921.) 25*s.* net.

SUCH a title challenges attention not merely as a scientific work but as a confession of faith. It is the *credo* of one of our younger men on education at this moment when there is nothing else of such importance. A huge and undigested heap of students has been shovelled into our universities by the combined pressure of war arrears and Government subsidies (8,000,000*l.* sterling is to be spent first and last by the Treasury alone on University courses for ex-officers). These men are our inevitable masters in the decade to come. Thus vital are the principles on which Prof. Graham Kerr decides to cultivate his garden.

The professor of zoology in Scotland has a dreadful task. In ten short weeks he has to expound and classify all the innumerable combinations of living matter. In addition he has to break in to the life of a university a class of many scores—sometimes of hundreds—of last year's secondary schoolboys. The biology of the first-year medical student has to unfold its

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broadest sweep when he is least capable of receiving it.

The 485 pages of reading matter and line drawings give the conspectus of the animal kingdom which it is hoped such a one may carry away. Prof. Graham Kerr in his preface sets himself three tasks: (1) To awaken and develop . . . interest in biological science. (2) To lay an adequate foundation for the superstructure of detailed knowledge of the animal body. (3) To provide a reasonably up-to-date account of the more important animal parasites, especially of the pathogenic microbes of animal origin.

The course represented by this book is preponderatingly morphological. The writer holds not only that our knowledge of the morphological features of the lower types of animal is much more advanced than our knowledge of their physiology, but also that morphological study affords a better intellectual discipline than physiological:

> "The student observes structural features in the laboratory . . . and he is able to compare what he observes with what he is told or reads. When he tries to make physiological observations he finds even in the case of the simplest phenomena that behind these phenomena are at work factors, so far as he is concerned, transcendental and as far beyond his powers of criticism and comprehension as if they were the direct result of supernatural agency."

The only quarrel a student could have with the book is one which it shares with so many scientific works—that it is all so true. Few things are more devastating to the unformed mind than first contact with the vast mass of knowledge which the ant-like industry of man has piled up through the last three centuries. When the process of selection is also hidden, and the innumerable errors by which we have arrived at truth, the student is apt to think that those who have taught him so much can teach him all. His faculty of scepticism, before the brute mass of all this verity, lies down baffled, and his powers of disbelief are not reawakened for years, or for ever. The intellectual stimulus of finding a great clinician out-faced and routed at a post-mortem should not, even for the earliest years, be neglected if in any fashion it can be reproduced in zoological lecture-room or laboratory.

Therefore, although the anatomy of the higher vertebrates has been excluded from the course and the mass of detail pruned vigorously, one would plead for still further selection. By a glance at the countless mistakes of the past the investigator of the future will be encouraged. One would beg the teacher, in delivering that cataract of certainty which batters on the head of the first-year student, to remind him not only of the rightness but of the wrongness of the theories of the past, that he may pluck up heart to question those which now are current.

The book is well printed, and the line drawings are numerous and comprehensible. For examination purposes the summaries ending each chapter will prove of great value. The chapter on the Flagellata and that on the Crossopterygii are of special interest in view of the work done in these two fields by the Glasgow school.

The Study of Rocks.

Petrographic Methods and Calculations, with some Examples of Results Achieved. By Dr. A. Holmes. Pp. xix + 515 + 4 plates. (London: Thomas Murby and Co., 1921.) 31*s*. 6*d*. net.

DR. HOLMES has produced a text-book that is likely to have a far-reaching and beneficial effect in promoting the intelligent study of rocks. Some scientific treatises are patient compilations of the common stock of theories and facts current among specialists in the subject treated. If they are at least fairly accurate and reasonably up-to-date and complete they may be of great use to the student and research worker, even if they contain little or nothing that is original or novel. Others strike out a new and independent line of their own, and deal only with certain aspects of the subject on which the author feels he has a message to deliver. These, of course, have a value of their own, though they are not available as text-books or as works of reference.

The special characteristic of the work under review is the keenness of Dr. Holmes's outlook for fresh ideas in every department of his subject. Sometimes he has evolved them for himself, sometimes he has added new developments of his own to the methods that he has met with in his unusually wide reading. He even succeeds in making the well-worn subject of specific gravity interesting, and embodies much American work that has recently been published, as well as his own experience in the investigation of building stones. In dealing with the procedure for the separation of rock minerals, he does full justice to the advances that have been made in this country in the last few years. His novel diagrams showing at a glance the refractive indices and bi-refringence of minerals are remarkably successful in giving an idea of their relations to one another and the variations that occur. The chapter on microchemistry should prove very useful, and

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